WYOMING COAL BED NATURAL GAS WATER MANAGEMENT TASK FORCE

INTERIM REPORT

DECEMBER 14, 2006

www.wycbmwater.gov

1.0 Introduction

The Coal Bed Methane Natural Gas Water Management Task Force (TF) was formed in May 2006 to address issues associated with produced water from coal bed methane (CBM) development throughout Wyoming. The TF was created by the Wyoming Legislature (Wyoming Senate File No. SF0093) with the specific purpose of: 1) "reviewing current statutes and regulations" and 2) "produced water management and alternatives and options currently available to or used by the coalbed natural gas industry".

This interim report was prepared for the Governor, the joint agriculture, public lands and water resources interim committee, the joint minerals, business and economic development interim committee and the general public. The TF is about half the way through its 18 month schedule and this report documents TF conclusions and recommendations based on information provided to date. A final report from the TF will be completed in October 2007.

It is important to recognize that the TF has not concluded its work. Several key issues, particularly those related to water management alternatives and possible regulatory gaps, still need to be investigated. Consequently, the TF will defer discussing alternative water management and regulatory options until the final report.

The TF consists of 15 members with a wide range of experience and expertise. Members include:

- Director of the Wyoming Department of Environmental Quality
- Supervisor of the Wyoming Oil and Gas Conservation Commission
- Chairman of the Wyoming Pipeline Authority
- Wyoming State Engineer
- Three members representing the coal bed methane natural gas industry
- Three members representing the agriculture industry
- Four members from the Legislature
- One member from the public at large

A complete list of TF members can be found on the TF website (wycbmwater.gov).

The TF has been provided with a plethora of information. Where possible the information has been posted on the TF website. For the sake of brevity, pertinent information contained on the website is summarized in this report.

During the initial meetings the TF developed a mission and strategy statement. As part of its mission, the TF decided to focus on identifying problems that currently exist or may exist in the future as CBM development increases. A great deal of the TF effort has been investigating landowner problems and issues. Although the TF responsibility is statewide, the focus has been on the Powder River Basin (PRB) where most development has occurred.

CBM Task Force Mission

The mission of the Task Force is to evaluate the statutes, rules, policies and practices that guide and control water management in the CBM industry and identify problems that exist now and may exist in the future. The Task Force will strive to utilize a consensus based approach in making decisions and recommendations related to CBM water management.

The TF has established six broad categories of work: 1) statutes, rules (regulations) and policies; 2) water management practices; 3) water management options; 4) understanding water production; 5) sources and trends of water production; and 6) the final report. The TF identified at least four elements under each of the broad categories:

- Fact finding (providing the TF with background and understanding of the topic)
- Discussions of the challenges, opportunities and issues associated with the topic
- Identification of possibilities where the TF may be able to have a positive impact. (This involves gaining clarity of any gaps between "as-is" situations and any goal for improvement)
- Developing specific recommendations and the work required to implement

2.0 Task Force Work Progress

2.1 Meetings

The TF met monthly beginning in May 2006. The public meetings were located in and around centers of CBM development throughout the state. On two occasions, a second day of site visits were scheduled. Notices of the meetings were provided on the TF website and in newspapers. The meetings were well attended.

TF Meetings

May 4, 2006 – Casper
June 1, 2006 – Gillette
July 6, 2006 – Buffalo
August 3, 2006 – Rawlins
September 7, 2006 – Lusk
October 5, 2006 – Sheridan
November 2, 2006 – Douglas
December 14, 2006 - Cheyenne

Consensus decision-making was used by the TF. Consensus decision-making means that all members could live with or support a statement or recommendation. If consensus could not be reached after substantial effort, the major and minor positions would be provided.

2.2 Public Comment

The TF accepted public comment at all but two of the meetings. The TF heard from individuals and organizations including representatives of the CBM industry, the ranching community, landowners, environmental groups, landowner organizations and concerned citizens. In addition, the TF website provides an opportunity for those who cannot attend the meetings to submit written comment.

Public comments have been useful in identifying and clarify issues and potential solutions. Comments from the public have ranged from being supportive to critical of current management techniques for CBM produced water.

2.3 Site Visits

The TF has visited CBM development facilities and areas where CBM produced water management has resulted in property impacts. In June 2006 several CBM operators provided a tour of "typical" CBM production facilities as well as containment reservoirs and a treatment facility. In addition, the TF was shown a surface irrigation application of CBM produced water. In October 2006 the TF visited a site where seepage from a produced water containment reservoir caused impacts to an adjacent alfalfa field. The TF also visited a site where CBM produced water was being applied using subsurface drip irrigation.

Agency Name Abbreviations Used in This Report

- WDEQ – Wyoming Department of Environmental Quality
- WSEO – Wyoming State Engineer's Office
- WOGCC – Wyoming Oil and Gas Conservation Commission
- WDA – Wyoming Department of Agriculture
- WDR – Wyoming Department of Revenue
- WGFD – Wyoming Game and Fish Department
- BLM – Bureau of Land Management
- WSGS – Wyoming State Geological Survey

In addition to the site visits, the TF has been provided photographs of property impacts from landowners and concerned citizens. The photographs were posted on the TF website and the TF has had numerous discussions regarding the impacts portrayed in the photographs. In each case the TF asked state

agencies and/or operators to explain their understanding of the factual situation on the property and the extent to the impacts.

2.4 Presentations Provided to the Task Force

Through the spring and summer of 2006 the TF focused primarily on fact finding. To better understand the complexities of CBM development and water management, the TF requested agencies, CBM operators, individuals and companies familiar with the issues associated with water production to make presentations. The TF actively sought presentations from those with expertise and experience with CBM produced water in Wyoming. When possible, the information provided was posted on the TF website. A complete list of presentations is provided on Table 1.

Table 1. List of Presentations Provided to the TF During 2006

Presenter	Information Provided
WSEO	Permitting requirements for CBM produced water
WSEO	CBM regulatory program
WOGCC	Overview of CBM development in Wyoming
WGFD	Description of Aquatic Resources in the PRB
WDEQ	CBM regulatory program
WDEQ	Montana CBM rule update
WSGS	PRB desalination project feasibility
WSEO	Regulation of impoundment seepage
WDEQ	CBM produced water agriculture policy
WDA	Benefits and conflicts with CBM produced water
WDR	Summary of severance and ad valorem taxes from CBM development
Western Research Institute	Irrigation with CBM produced water and monitoring applications via remote sensing
K.C. Harvey and Associates	Managed irrigation for the beneficial use of CBM produced water and soils, vegetation, agriculture and riparian systems in the PRB
K.C. Harvey and Associates	A primer on CBM produced water chemistry and potential effects on soils
EMIT	Counter current ion exchange applied to PRB water treatment
Campbell County Conservation District	CBM produced water issues in the district
Lake De Smet Conservation District	CBM produced water issues in the district
BeneTerra	Harvesting CBM produced water for agriculture with subsurface drip irrigation
Petroleum Association et al.	Mediation options
Wyoming Pipeline Authority	Pipeline alternatives

3.0 CBM Development in Wyoming

The WOGCC provided information to the TF regarding the locations of current and future CBM development in the state. While the majority of current development is occurring in the PRB in the northeast portion of the state, CBM development potential is being explored in other areas of Wyoming (See Figure 1).

By the end of 2005, WOGCC had issued over 48,000 permits for CBM wells in the PRB. Of the total permitted wells, almost 24,000 wells had been drilled, about 21,500 wells had been completed and about 15,500 were producing. Approximately 6,000 wells were shut in for a variety of reasons including about 1,300 which were awaiting development or approval of water management plans. Members of the TF representing the CBM industry have stated that finding satisfactory options for managing produced water is one of the biggest challenges facing the companies involved with CBM development.

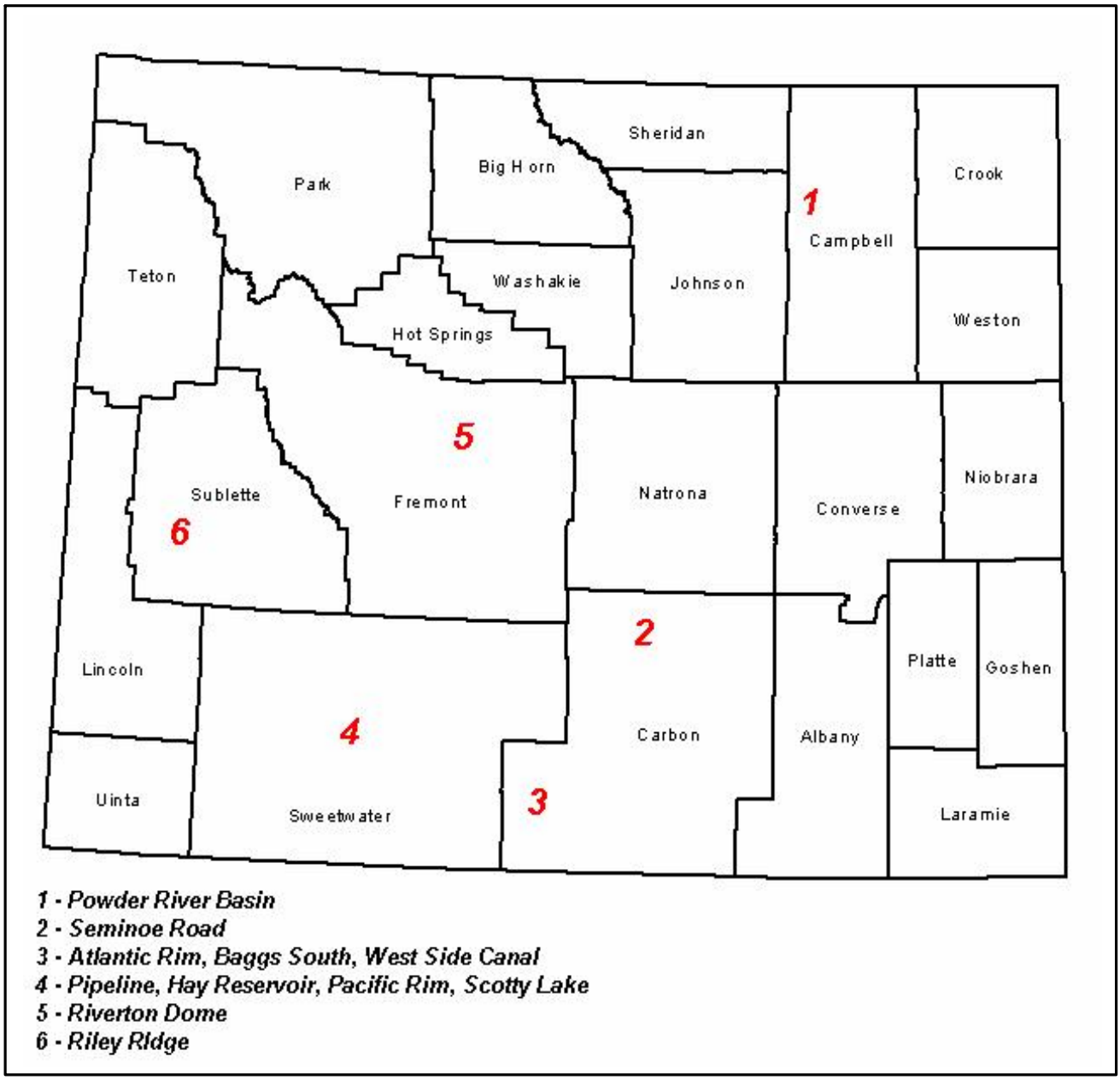

Figure 1. CBM Development Areas in Wyoming

In 1996 the WOGCC issued 131 new CBM well permits in the PRB. In 2005 that number increased to over 7,000 new well permits. To date, peak drilling occurred in 2000 and 2001 when about 4,500 and 4,300 wells were drilled in the PRB, respectively. Since the peak, new well drilling has declined somewhat with an average of about 2,700 new wells being drilled each year between 2002 and 2005.

During 2005 CBM operators produced about 336 billion cubic feet (BCF) of natural gas from coals in the PRB – mostly from the Wyodak and Big George coals. Cumulative production through the end of 2005 from the PRB has been estimated by the WOGCC to be approximately 1.8 trillion cubic feet (TCF) of natural gas.

The TF is aware that a variety of groups have made projections of CBM recoverable reserves from Wyoming. These projections usually include forecasts of reserves, drilling activity and water production. Following the advice of the WOGCC, the TF has concluded that any projections of future levels of development are problematic. However, all the forecasts that were examined indicate that water production from CBM development in the PRB will increase. Those increases will be dependent upon the pace of development.

The TF intends to utilize the WOGCC projections as a baseline for decision making. The WOGCC has provided the TF with its best estimate of where and to what level CBM development will occur in the near future, including what the agency expects in terms of water production associated with this development.

Converting Water Units

1 barrel = 42 gallons
1 acre-foot = 325,851 gallons
1 acre-foot = 7,758.4 barrels
1 million gallons per day = 1.55 cubic foot per second

To produce natural gas from the coals, water is removed to allow the natural gas to move from the coals to the well bore and to the surface. In 2005 CBM operators pumped approximately 557 million barrels of water (about 72,000 acre-feet) from the PRB coals which equates to about 1.66 barrels of water for each thousand cubic feet (MCF) of gas. Cumulative water production between 1987 and the end of 2005 was approximately 3.5 billion barrels of water or about 446,000 acre-feet. At the request of the TF the WOGCC estimated cumulative water production from the PRB from 2006 through 2029 at 11.6 billion barrels. WOGCC projects water production to peak between 2011 and 2014 at about 1.2 billion barrels annually (or double current rates) and then decline through 2029 (see Figure 2).

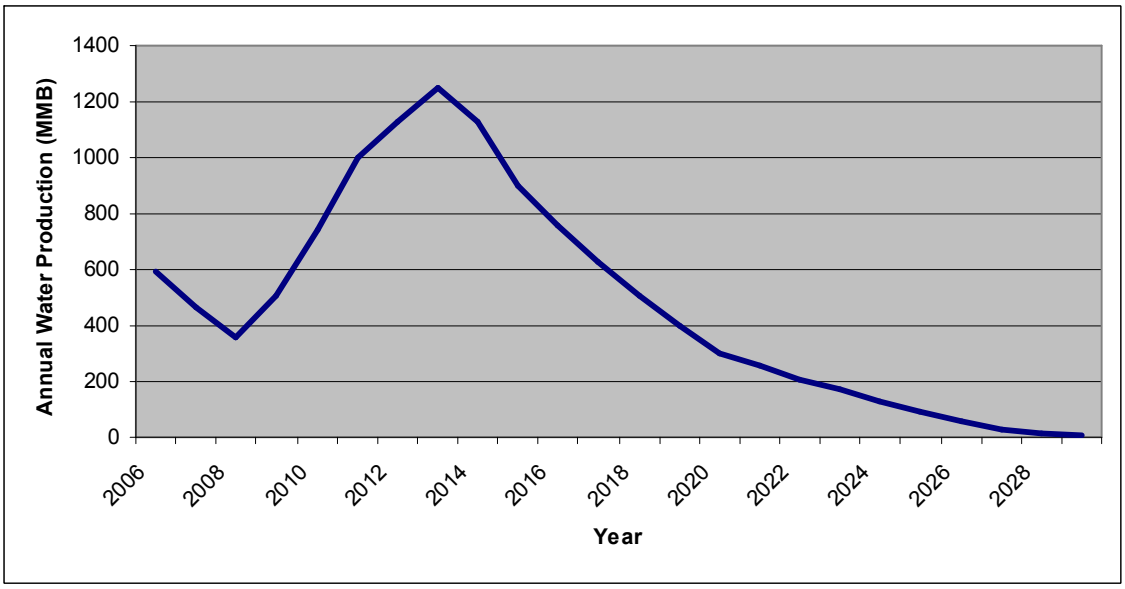

Figure 2. WOGCC Estimated Water Production from the PRB

The second most active CBM play in Wyoming is Atlantic Rim in Carbon County. Between 1999 and the end of 2005 operators had drilled 131 CBM wells in Atlantic Rim. Cumulative water production over the same period was about 37 million barrels. WOGCC estimates that about 1,700 additional CBM wells will be drilled in Atlantic Rim through 2015. The BLM is currently preparing an environmental impact statement for Atlantic Rim. The operators have informed BLM that they currently intend to inject all water produced from Atlantic Rim.

Between 1999 and 2005 21 wells were drilled in Seminoe Road in Carbon County. Total cumulative water production to date is estimated at about 18 million barrels. WOGCC estimates that an additional 1,200 wells will be drilled in Seminoe Road through 2016 and that cumulative water production may reach about 750 million barrels.

Very few wells have been drilled in CBM resources elsewhere in the state. Based on the lack of information currently available, it is beyond the scope of the TF to assess the potential for gas or water development from these other areas.

It is clear that water production from CBM development will continue to increase. If WOGCC forecasts for the PRB are correct, water production will double. Obviously, increased water production will only exacerbate current conflicts between development and landowners. Taking steps now to resolve these conflicts will lessen future negative impacts.

4.0 Major Issues Identified by the Task Force To Date

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Issue 1: Concerns of downstream landowners regarding water quantity and discharge quality to assure that discharges do not exceed receiving stream capacity or adversely affect downstream landowner use of their property. Operators, the public and the agencies should explore opportunities to add value to the produced water and find ways to maximize additional use of the produced water within each watershed.

Issue 2: Retention of produced water in the state of Wyoming. The TF believes that produced water should be retained in the state.

Issue 3: Putting produced water to additional use. The TF is looking at opportunities and incentives that can be developed to add value to the produced water.

Issue 4: Balance maximizing and retaining state and local government revenues from CBM production with protecting the surface and mineral property rights where development occurred. The TF is looking at opportunities to meet the interests of all affected parties.

Issue 5: Should a landowner be required to accept discharge-related impacts whether they want it or not? The TF continues to search for opportunities to create additional options for landowners who do not want produced water to flow across their property.

Issue 6: Is the value of agricultural bottomlands adequately protected? Bottomlands are of value to agriculture producers. The TF is awaiting the final WDEQ agriculture use policy (Section 20, Chapter 1). The TF will not review the draft policy.

Issue 7: There is a need to develop non-court dispute resolution mechanisms for settling water-related differences between landowners and operators. The Petroleum Association of Wyoming, in concert with the Wyoming Farm Bureau, Wyoming Woolgrowers, Wyoming Stockgrowers, and Wyoming Association of Conservation Districts, has proposed a dispute resolution mechanism. The TF will review the proposal when submitted.

Issue 8: Need to balance water production, costs and uses. The TF is involved in a full discussion of issues relating to environmental, social, economic and other interests.

Issue 9: Reliable production estimates. The TF recognizes that current, reliable estimates of gas and water production are important for TF recommendations.

Issue 10: Watershed permitting is a valuable tool in CBM development. Watershed permitting currently being conducted by the WDEQ could become a much more valuable mechanism for addressing concerns of landowners, particularly those downstream of development activities. While WDEQ anticipates that eventually all watersheds in the PRB will be covered by general watershed discharge

permits, the TF recommends that this process be accelerated and that an aggressive schedule be developed to complete these permits for the entire PRB. If additional resources are necessary to complete the watershed permits on an accelerated schedule, the TF encourages the Legislature to provide these resources in a timely manner.

Issue 11: Regulatory and statutory gaps. TF discussions with state agencies indicate that there is currently no state regulatory framework to allow limits to be set on the quantity of water discharged in a stream channel unless a direct relationship exists between the quantity of the water and water quality degradation. In addition, WDEQ lacks specific authority to regulate subsurface seepage from reservoirs. The TF is reviewing the regulations for legislative consideration.

5.0 Summary of Positive and Negative Impacts Associated with CBM Produced Water

Based on public comment and discussions with landowners and operators, the TF determined that a landowner's perception of the benefit and impacts of CBM produced water is based in part on their relationship with CBM operators active on their property and whether the landowner receives direct or indirect benefit from the produced water.

Summary of Benefits and Impacts of CBM Produced Water (Broad Categories)

Positive Impacts

1. Irrigation
2. Livestock and wildlife watering
3. Aquatic resource habitat creation
4. Wetland creation
5. Municipal water supply
6. Augmented water supply in areas of need

Negative Impacts

1. Bottomland and vegetation composition
2. Soil salinity and sodicity
3. Bottomland agricultural operations
4. Stream channel morphology
5. Aquatic resources (habitat modification)
6. Downstream water quality and quantity (non-WYPDES)

5.1 Positive Impacts

The TF has found that often landowners and CBM operators develop mutually-beneficial and respectful working relationships which provide ranching operations to benefit directly and/or indirectly from CBM development. Written agreements are generally used between landowners and industry to address, among other things, water management on the property.

On many ranches in the PRB, CBM produced water is used for livestock watering. Wildlife undoubtedly use CBM produced water throughout the PRB. The TF has heard from a number of ranchers who have been able to achieve better pasture use and improved stocking rates by watering livestock with CBM produced water. Landowners, often with the voluntary assistance of CBM operators, have installed pipelines, reservoirs, stock tanks and guzzlers. The WDA estimates that nearly 14,000 stock water permits have been issued for CBM produced water in the PRB.

To date over 60 irrigation permits have been issued for CBM produced water. Although the practice of using CBM produced water for irrigation is controversial, the TF believes with careful monitoring (which seems to be occurring in most cases) and proper technical guidance (particularly regarding the use of soil amendments) that irrigation with CBM produced water is an acceptable secondary use which can be extremely beneficial to the landowner. It has been estimated that approximately 5,000 acres are currently irrigated in the PRB using CBM produced water. Pivots, side-rolls and subsurface drip irrigation are all being used. The TF will further evaluate the potential for expanding use of CBM produced water for irrigation.

Perhaps the best known benefit from CBM development in the PRB is the significant revenues generated for State and local governments. The WDR provided the TF with a summary of severance and ad valorem taxes generated by CBM development in 2004. In that year the State collected nearly $75 million in severance tax from CBM production. Of the total state severance tax collection over $4 million was allocated to cities and towns across the state; $23 million was allocated to the general fund; $30

million was placed in the permanent mineral trust fund; and about $4.5 million was allocated to water development accounts. CBM development is an equally important revenue source for local governments. Ad valorem tax collections for 2004 for counties in the PRB were: Johnson County over $5.5 million; Sheridan County nearly $12 million; and Campbell County over $57 million.

5.2 Negative Impacts

Based on information provided to date, the TF has concluded that most CBM operators do a good job in working with landowners to address their concerns (particularly where landowner agreements are in place). However, as can be expected, there are some cases where landowners and the CBM operators have been unable to develop a positive working relationship. Usually, there is no landowner agreement in place. On occasion the relationship appears to be mutually hostile. In these cases the landowners can incur significant legal costs in attempting to address damage from CBM development.

The TF has been provided information regarding the negative impacts from CBNG produced water. Often there is a change in riparian vegetation which is generally viewed as negative by the ranching community. There may be a loss of woody vegetation due to inundation of water. Changes in soil salinity and sodicity adversely affect soil productivity. Many of the ephemeral streams are becoming perennialized which changes the stream channel morphology.

Some landowners have been affected by CBM development from discharges upstream of their property. These downstream landowners do not receive direct and indirect benefits from development on their property. However, the downstream landowner still has to deal with the impacts of discharged CBM produced water in drainages across their property. In these cases, the landowners often have no working relationship with the operators and there is no opportunity to address their concerns through landowner agreements.

5.3 Other Impacts

The TF recognizes that agriculture production and property value may be impacted by CBM activity. However this is out of scope of the TF charge.

5.4 Beneficial Use

It is important to recognize that WSEO has determined that CBM produced water is “beneficially” used during the production of natural gas. This use is similar to the beneficial use of water for dewatering a mine pit so that coal can be mined or dewatering a trench for installation of utilities.

6.0 Priorities for Final Report

Based on information reviewed to date, the TF believes the following next steps are prudent.

A. The TF will address water quantity regulatory gaps

To a large extent public comments received by the TF which is critical of CBM produced water discharges focus on the quantity of water discharged into stream channels and the impacts to downstream landowners. The TF does not believe that an adequate regulatory structure exists to protect downstream landowners from water quantity impacts. The WDEQ has informed the TF that it lacks specific authority to limit the quantity of CBM produced water discharge unless the quantity of the discharge adversely affects water quality. The WSEO similarly lacks specific authority to regulate the quantity of water discharge.

The potential exists for discharge of CBM produced water to exceed the capacity of the receiving stream channel which can result in flooding. This has occurred on a property near Arvada. The bottomlands on this property are supported by a meandering stream channel which has been estimated

by WDEQ to be capable of containing about 1.5 cubic feet per second (cfs). Prior to November 2006, WDEQ had permitted discharges totaling about 5 cfs above the property which resulted in the flooding. In November 2006 WDEQ issued additional permits totaling approximately 25 cfs of produced water discharge in the watershed above the property. While not all or even a significant portion of the 30 cfs is expected to reach the property, enough has already reached the bottomlands to cause flooding. The additional discharge permits upstream are expected to exacerbate the problem on the property.

In cases where channel capacity is likely to be exceeded by cumulative discharges, one option could be to install and maintain a conveyance for the water across the property (using, for instance, ditching (lined and unlined), increasing natural channel capacity, or piping) or an alternative method of CBM produced water disposal.

B. The TF will develop a proposal for a mitigation process to address unanticipated impacts

WDEQ believes that the best available science indicates that water quality limits currently imposed in discharge permits are adequate to protect current and future land uses. However, there remains considerable debate and some have suggested that the salinity and sodicity of CBM produced water could result in long-term loss of soil productivity.

The TF applauds CBM operators who have assisted landowners who have lost water wells as a result of dewatering the coals. Most lost water wells have been replaced by the operators voluntarily with little recognition of their efforts. However, the TF is aware of several instances where landowner wells have been lost, allegedly due to adjacent CBM development, where a CBM operator did not volunteer to resolve the issue or where there was disagreement between the CBM operator and the landowner as to how the problem should remedied. We are also aware of several interference claims investigated informally the WSEO where no action could be taken because the landowner's well was not completed to the bottom of the water bearing aquifer or produced through artesian flow or the well utilized pipe too small in diameter to receive a pump. In these cases the WSEO concluded that the adjacent CBM development did not result in unreasonable interference and the landowners have had to find alternative sources of water.

C. The TF will explore regulatory authority for produced water storage reservoirs and development of minimum standards for liners and criteria for siting reservoirs

The TF will explore whether permitting authority for all CBM storage reservoirs should be consolidated into a single agency. Further, the TF will explore whether agencies should develop minimum standards for siting reservoirs and the use of liners by determining where reservoirs represent a risk to adjacent land uses and natural resources.

7.0 Recommendations

Watershed permitting should be expedited

The TF believes that watershed permitting, currently being conducted by WDEQ, is an excellent mechanism to involve landowners in decisions made about upstream CBM development that may affect their downstream property. Consequently, the TF recommends that the WDEQ proceed expeditiously with watershed permitting in the PRB and that watershed permitting be completed as soon as possible and well prior to peak produced water production. The TF further recommends that the Legislature provide any needed authority and approve the necessary funding to expedite watershed permitting.